

# BOSCH

TEST INSTRUCTIONS

**41**

VDT-WPP 116/1 B  
<VDT-W-413/301 B>  
Ed. 1

## Fuel Injection Pumps

0 413 ... - PE (S) ... MW ...

## Contents

Page	
2	1. Introduction
3	2. Testing Equipment and Tools Required
4	3. Clamp the Fuel Injection Pump in Place for Testing
4	4. Test Port Closing and Adjust Plunger Lift to Port Closing
5	5. Test and Adjust Fuel Delivery
7	6. Auxiliary Tools

## 1. Introduction

This booklet describes the adjusting and testing of Fuel Injection Pump (PE(S) ... MW. ...

The sequence of illustrations and accompanying text given here represents the most effective sequence of the individual steps.

The construction and operation of this fuel injection pump are described in Technische Mitteilung VDT-BEP 102/1 B < VDT-1-403/1 B >.

Special testing equipment and tools required for testing and adjusting this fuel injection pump are listed in Section 2.

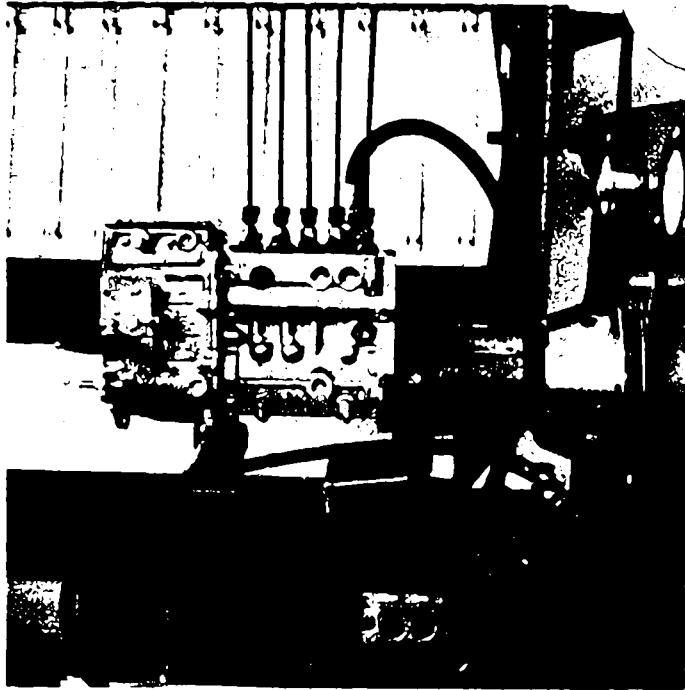
Use Calibrating Oil 61 v 11 or Shell Calibration Fluid B with a temperature of  $40 \pm 5^\circ$ .

Published by Robert Bosch GmbH,  
Automotive Equipment Trade Division, After-Sales Service,  
Department for Technical Publications KH/VDT  
D-7 Stuttgart-1, Postfach 50

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## 2. Testing Equipment and Tools Required

Testing Equipment Tool	Part Number Type	Use
Testing equipment	see VDT-WPP 110/2 B (such as PES ... M ...)	
1 Clamping bracket	1 688 010 010 EFEP 157	For test bench with shaft height 125 mm
	1 688 010 011 EFEP 157 A	Shaft height 110 mm
1 Flange	1 685 720 018 EFEP 157/6	PES ... with 3-hole flange
	1 685 720 017 EFEP 157/4	PES ... with 4-hole flange
with ring	1 680 202 005 EFEP 29/0/3	Internal diameter 68 mm
1 Mounting device	1 688 030 111	PE with cradle mounting
1 Setting device	0 681 440 006 EFEP 56 C	
1 Plunger lift to port closing measuring device	1 688 130 135	
1 Control-rod travel measuring device	1 688 130 134	
1 Dial indicator, measurement range 30 mm, graduations 1/100 mm,  if not available,  dial indicator, measurement range 10 mm, graduations 1/100 mm, with measurement insert 14 mm long	1 687 233 012 EFAW 63    1 687 233 011 EFAW 7	For plunger lift to port closing measuring device
1 Dial indicator, measurement range 30 mm, graduations 1/10 mm (without return spring)	1 687 233 015 EFAW 144	for control-rod travel measuring device



### 3. Clamp the Fuel Injection Pump in Place

Clamp the fuel injection pump together with the governor onto the test bench using the proper clamping bracket, flange, or mounting device (see Section 2).

Remove the rear governor cover.

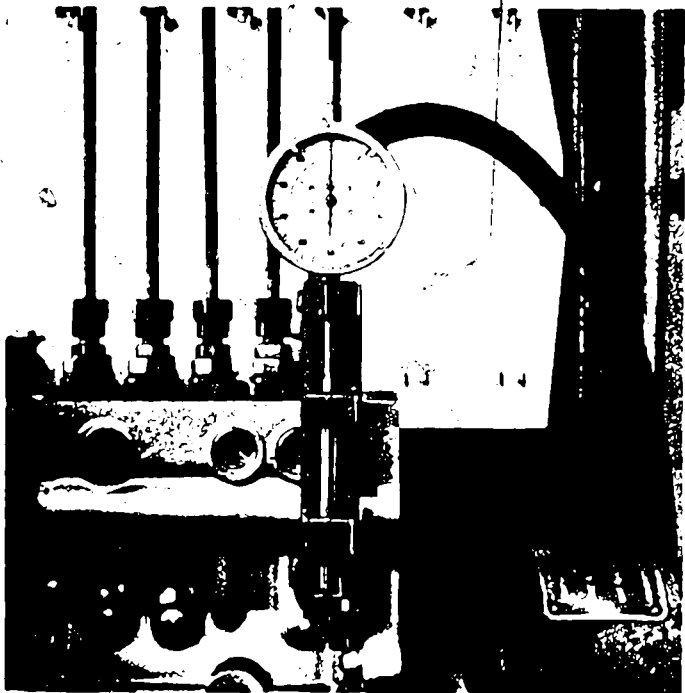
Connect the nozzle holder assemblies and the fuel injection tubing (see Section 2), applying counterpressure to the valve holders as this is done.

Unscrew the supply pump and fill the camshaft chamber with HD engine oil.

Quantity of oil required:

PE(S) 2 ... to PE(S) 5 ... 0.25 l.  
PE(S) 6 ... to PE(S) 12 ... 0.50 l.

Then close the supply pump hole with a cover (for example 1 900 508 024).



### 4. Test Port Closing and Adjust Plunger Lift to Port Closing

The **plunger lift to port closing** is the distance in mm from the bottom dead center position of the piston to port closing.

Connect the feed hose at the suction gallery of the injection pump.

Close the return flow hole with the proper screw plug (with shoulder and hexagon socket) and seal ring.

Attach the plunger lift to port closing measuring device **without** the seal ring in the bottom dead center position of the tappet at outlet 1. When doing this be sure that the measuring device sensor rests against the roller tappet.

Set the dial indicator to "0" in the bottom dead center position of the roller tappet.

Mount Setting Device EFEP 56 C on the test bench and align it.

Set the control rod with the control lever to max. control-rod travel and fix it in this position with the setting device.

In special cases the control rod position is given in the test specification sheet (mount the dial indicator as described in Section 5).

With the bleeder screw open at the calibrating nozzle holder assembly attached to outlet 1, increase the **feed pressure** until calibrating oil comes out of the overflow tube with no bubbles.

Turn the camshaft slowly in the direction of rotation until port closing is reached.

**Port closing** is reached when the flow of calibrating oil from the overflow tube at the nozzle holder assembly is changed to drops.

Read the dial indicator and compare this reading with the value given as "Port closing at plunger lift to port closing" in the test specification sheet. When checking the fuel injection pump, the value given in parentheses can be increased by the tolerance given in the test specification sheet.

Compensation is made for deviations from the nominal measurement by inserting the proper adjusting plates (available in thickness steps of 0.05 mm) between the barrel and valve assembly and the pump housing.

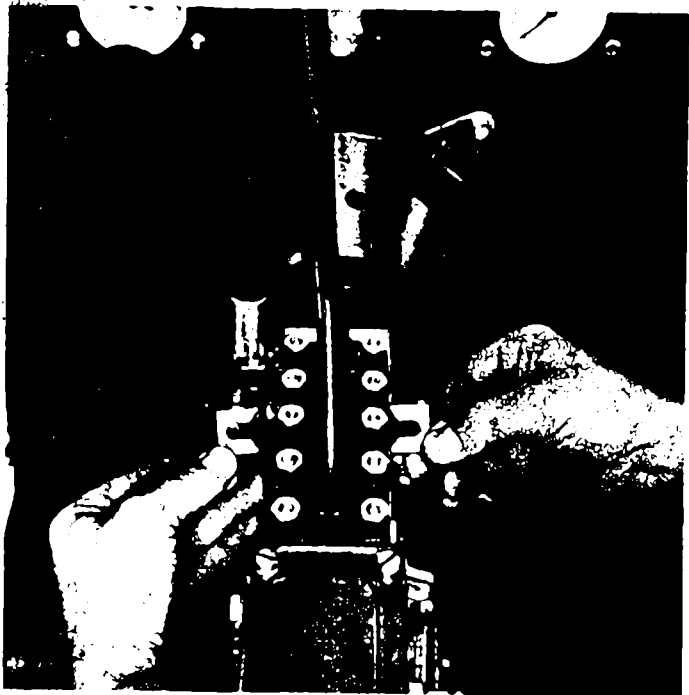
**Caution:**

Adjusting plates of the **same** thickness (same identifying number) must be used on both sides of the barrel and valve assembly, and only one plate should be inserted on each side.

- At the specified plunger lift to port closing of outlet 1, set the needle on the graduated disc on the test bench to a number of degrees favorable for the reading. Close the bleeder screw at the nozzle holder assembly.

Remove the plunger lift to port closing measuring device and seal the threaded hole with a new seal ring. Port closing of the other plunger and barrel assemblies is set according to the number of degrees of angular cam spacing, starting from the tested or adjusted first cylinder.

3



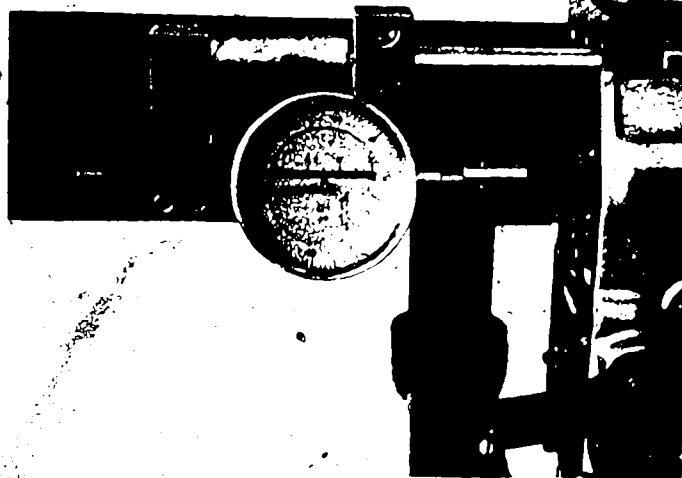
Normal cam sequence:  
with 4 cylinders: 1-3-4-2,  
with 6 cylinders: 1-5-3-6-2-4.

The angular cam spacing =  $360^\circ$  divided by the number of cylinders (for example, with the PE(S) 6:  $360^\circ / 6 = 60^\circ$ ). Permissible adjustment tolerance:  $\pm 0.5^\circ$ .

Abnormal angular cam spacings are given in the test specification sheet.

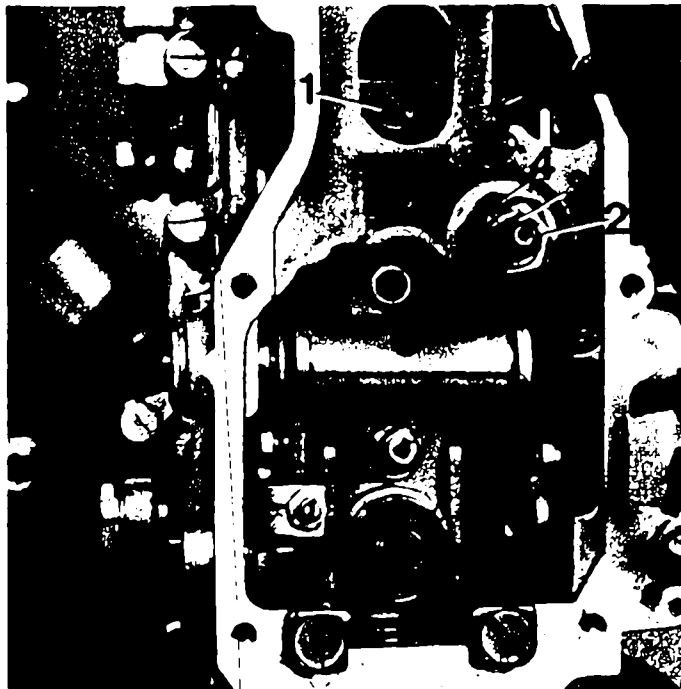
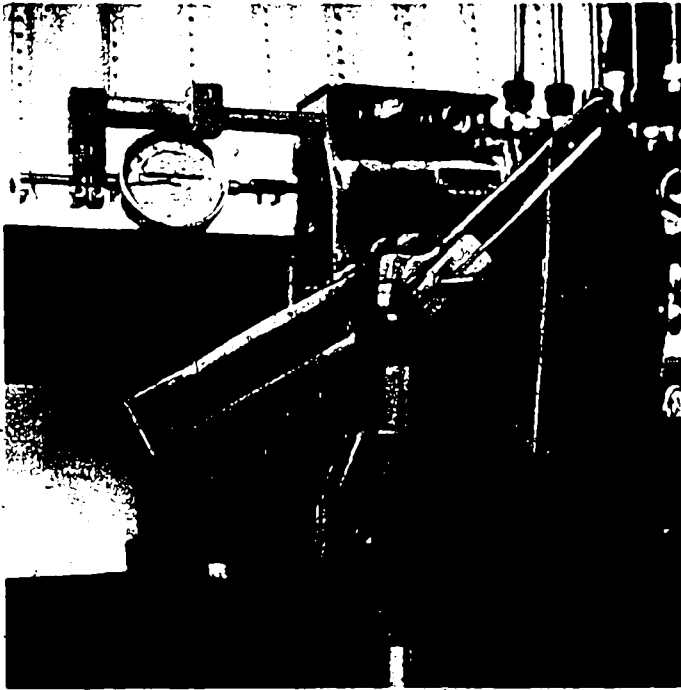
## 5. Test and Adjust Fuel Delivery

Mount the control-rod travel measuring device onto the governor housing. Screw the threaded bolt together with magnet into the control rod. Press the control rod to the end limit stop and set the dial indicator to "0".



4

5



If support threads (M8) are provided on the governor housing, a homemade support bracket with spacer piece (see Section 6) must be mounted between the injection pump and the test bench.

We recommend that a governor cover that has been cut off, together with a gasket, be mounted in order to prevent the oil from flowing out.

Close the overflow valve at the suction gallery return flow hole.

Set the suction gallery pressure of 1 bar (with flushing).

#### RW Governor

Pretension the governor spring completely by turning the adjusting screw (1) all the way in. Also turn the adjusting screw (2) for the follower lever all the way in; for this purpose release the hexagon nuts (3, 4).

Then tighten the hexagon nuts (3, 4).

Drive the fuel injection pump at the speed given in the box in Section "A" in the test specification sheet; set the specified control-rod travel using the control lever, and fix it in this position.

#### RWV Governor

Pretension the governor spring completely by turning the adjusting screw (1) all the way in.

Set the control lever completely to the full-load nominal speed. Release hexagon nuts 3 and 4.

Drive the fuel injection pump at the speed given in the box in Section "A" of the test specification sheet and set the specified control-rod travel with adjusting screw 2.

Then tighten hexagon nuts 3 and 4.

## RW and RWV Governors

Check the quantity of fuel sprayed.

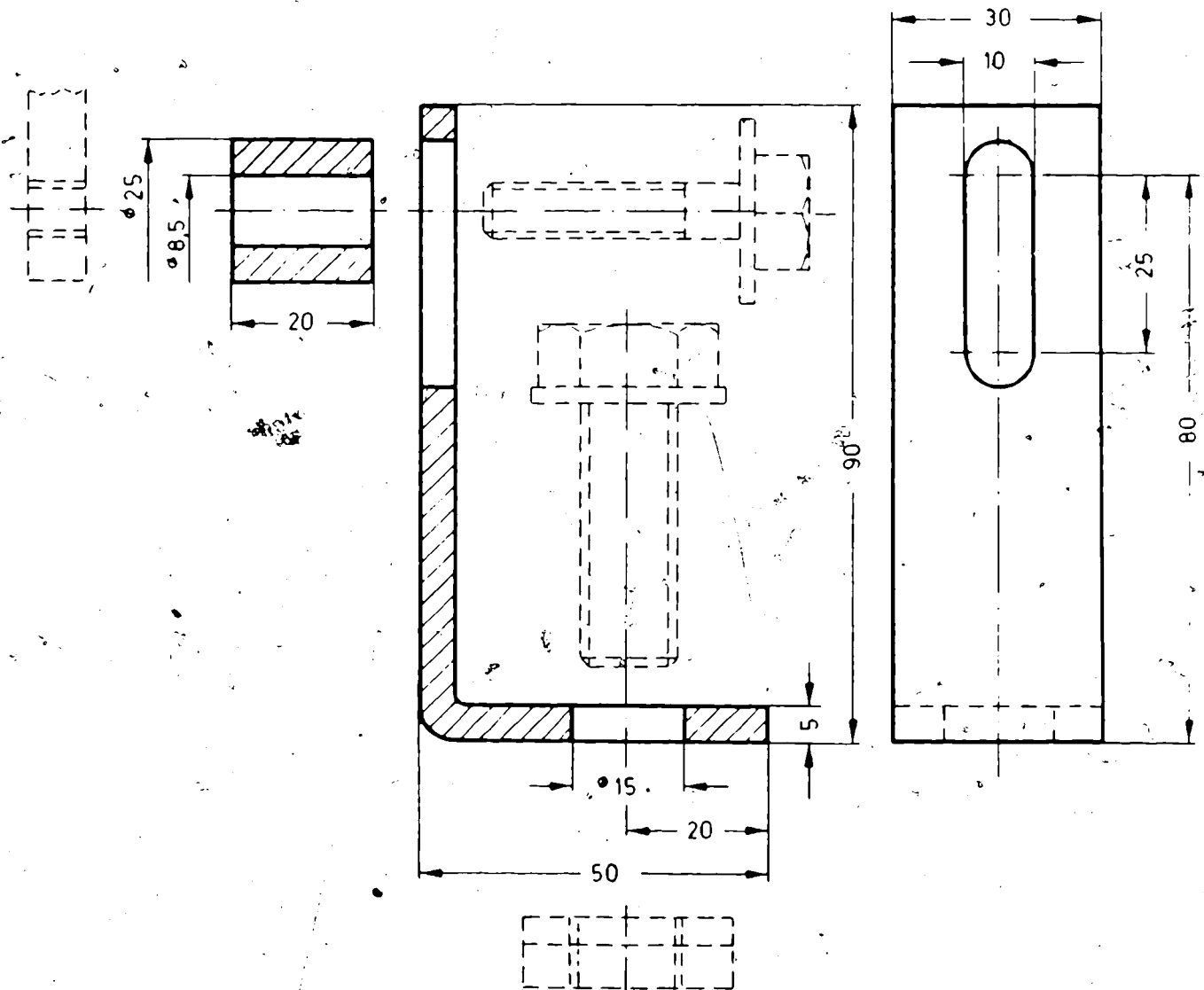
The basic fuel delivery setting applies as a pre-setting (100-stroke measurement) and is adjusted by turning the barrel and valve assembly. For this purpose, release the fuel injection tubing (apply counterpressure to the delivery valve holder when doing this) and the hexagon nuts at the barrel and valve assembly.

Retighten the hexagon nuts at the barrel and valve assembly as well as the retaining nut at the fuel injection tubing. For tightening torques see VDT-WJP 116/1 B or VDT-WJP 101/2 B.

The permissible difference in fuel delivery given in column 4 of the test specification sheet applies for the plunger and barrel assemblies of one fuel injection pump. The fuel delivery given in column 3 is the average value for all plunger and barrel assemblies.

The governor, full-load delivery, and the final value of the fuel delivery difference are adjusted according to Test Instructions VDT-WPP . . . . as well as Sections "B" and "C" of the test specification sheet.

## 6. Auxiliary Tools



# After-sales Service Instructions

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## Testing

**41**

VDT-W-413/301 En  
Suppl. 1  
Ed. 1

## Fuel-Injection Pumps

PE (S) . . . MW . . . S 1000 . . . and S 1500 . . .  
with 10-mm Plunger Lift



## Contents

Page	
3	1. Introduction
3	2. Special Tools
4	3. Test the Fuel-Injection Pump
7	4. Auxiliary Tools

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Printed in the Federal Republic of Germany.  
Imprimé en République Fédérale d'Allemagne  
par Robert Bosch GmbH.  
(3.78)

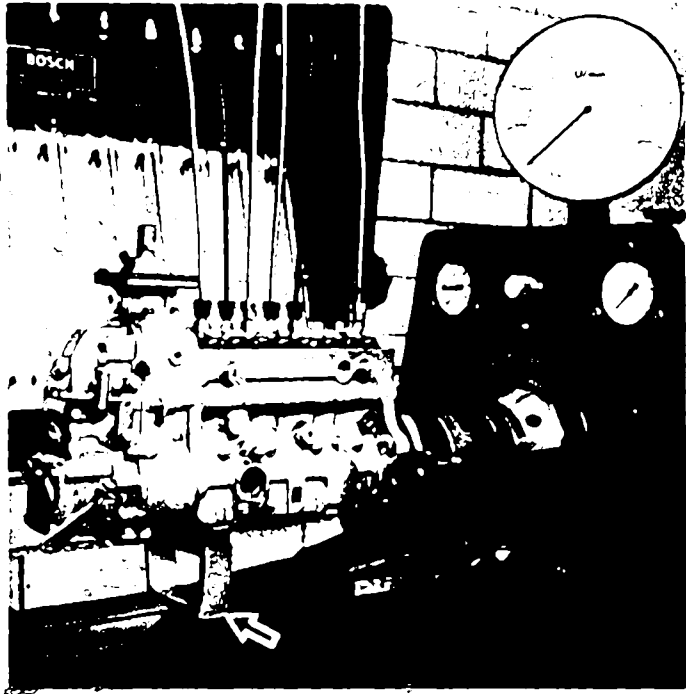
## 1. Introduction

This supplement to Test Instructions VDT-W-413/301 B refers to the testing and adjustment of Fuel-Injection Pumps PE(S), MW, S 1000, and S 1500, with 10-mm plunger lift.

Some special tools are required for this testing and adjustment work, and are listed in Section 2 below.

## 2. Special Tools Required

Test Equipment Tool	Part Number, Type Designation	Use
Test equipment	see VDT-WPP 110/2 B	PES..M..
1 Clamping bracket	1 688 010 010 EFEP 157	For test bench with shaft height 125 mm
	1 688 010 011 EFEP 157 A	Shaft height 110 mm
1 Flange	1 685 720 017 EFEP 157/4	PES..MW..S 1000.. with 4-hole flange
with ring	1 680 202 005 EFEP 29/0/5	Pilot diameter 85 mm
1 Flange	1 685 720 060 EFEP 157/7	PES..MW..S 1500.. with large 4-hole flange (pilot diameter 95 mm)
2 Mounting devices	1 688 030 111	Fuel-injection pumps with cradle mounting
1 Plunger lift to port closing measurement device	1 688 130 135	To measure the plunger lift to port closing
with sleeve	1 683 350 066	
and driving pin	1 682 012 008	
1 Control-rod travel measuring device	1 688 130 030 or	To measure and adjust the control-rod travel
tube fitting	1 688 130 130	
tube fitting	1 683 350 064	
driving pin	1 683 350 065 1 683 201 013	
1 Dial indicator, measurement range 30 mm, graduations 1/100 mm	1 687 233 012 EFAW 63	For plunger lift to port closing measurement device
1 Dial indicator, measurement range 30 mm, graduations 1/10 mm (without return spring)	1 687 233 015 EFAW 144	For control-rod travel measuring device
1 Setting device	0 681 440 006 EFEP 56 C	
1 Support piece	1 688 030 122	For fuel-injection pumps with end-flange mounting



### 3. Test the Fuel-Injection Pump

#### 3.1 Clamp the Fuel-Injection Pump In Place

Clamp in the fuel-injection pump together with the governor to the proper clamping bracket or mounting device (Section 2). For this purpose, the clamping flange must be modified (Section 4, Figs. 5 and 6).

Connect the nozzle-holder assemblies and fuel-injection tubing, applying counterpressure to the valve holders as this is done.

PES fuel-injection pumps must be supported by the support piece (arrow).

Unscrew the supply pump and fill the camshaft chamber with HD engine oil.

#### Quantity of oil required:

PE(S) 2.. to PE(S) 5.. = 0.25 l

PE(S) 6.. to PE(S) 12.. = 0.7 l

Then close the supply-pump hole with a plastic cover (for example, 1 900 508 024).

Remove the governor cover and mount the protective cover (to be made by the user, see VDT-WPP 001/4 B, Suppl. 6).

#### 3.2 Test Port Closing and Adjust Plunger Lift to Port Closing

The **plunger lift to port closing** is the distance in mm from the bottom dead center position of the plunger to port closing.

Connect the feed hose at the suction gallery of the injection pump.

Close the return flow hole with the proper screw plug (with shoulder and hexagon socket) and seal ring.

Attach the plunger lift to port closing measuring device **without** the seal ring in the bottom dead center position of the tappet at outlet 1 (or at the last outlet on the governor side). When doing this be sure that the measuring-device sensor pin rests against the roller tappet. Set the dial indicator to "0" in the bottom dead center position of the roller tappet.

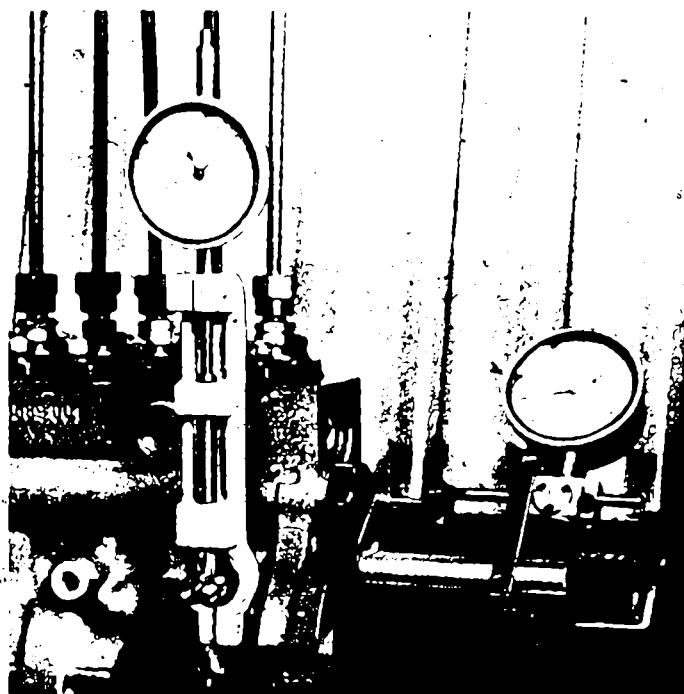
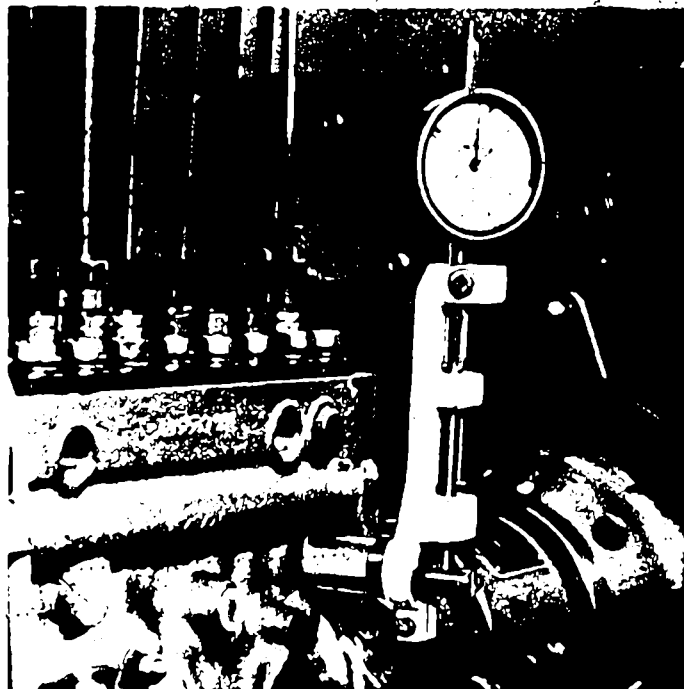
Mount the control-rod travel measuring device on the drive side of the pump housing. In order to do this, proceed in the following manner:

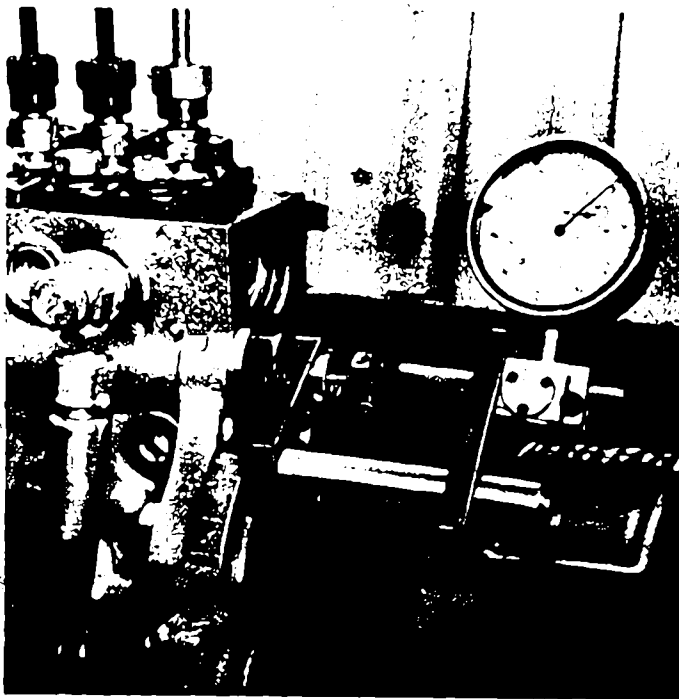
Remove the screw plug, and screw the headless screw (M3) into the control rod. Screw the clamping sleeve into the housing, and mount the dial-indicator holder. Place the dial indicator in the holder, and screw the coupling section into the measuring base of the dial indicator. With the control rod in the STOP position, set the dial indicator to "zero" and clamp the coupling piece onto the headless screw. Be sure that the control rod can move from one end position to the other (travel of about 21 mm) (Fig. 3). Set the control-rod travel specified.

With the bleeder screw open at the calibrating nozzle-holder assembly attached to the corresponding outlet, increase the **feed pressure** until calibrating oil comes out of the overflow tube without bubbles.

Turn the camshaft slowly in the direction of rotation until port closing is reached.

Port closing is reached when the continuous flow of calibrating oil from the overflow tube at the nozzle-holder assembly changes to drops.





Read the dial indicator and compare this reading with the value given as "Port closing at plunger lift to port closing" in the test-specification sheet. When checking the fuel-injection pump, the value given in parentheses can be expanded by the tolerance given in the test-specification sheet.

Compensation is made for deviations from the nominal measurement by inserting the proper adjusting plates (available in thickness steps of 0.05 mm) between the barrel-and-valve assembly and the pump housing.

**Caution:**

Adjusting plates of the same thickness (same identifying number) must be used on both sides of the barrel-and-valve assembly, and only one plate should be inserted on each side!

At the specified plunger lift to port closing of outlet 1, set the needle on the graduated disc on the test bench to a number of degrees favorable for the reading. Close the bleeder screw at the nozzle-holder assembly.

Remove the plunger lift to port closing measuring device and seal the threaded hole with a new seal ring. Port closing of the other plunger-and-barrel assemblies is set in the same way at the proper number of degrees of angular cam spacing, starting from the tested and/or adjusted first cylinder.

The angular cam spacing =  $360 \div$  the number of cylinders (for example, with the PE(S) 6...  $360 \div 6 = 60$ ). Permissible adjustment tolerance  $\pm 0.5$ .

Abnormal angular cam spacings are given in the test-specification sheet.

Connect the overflow valve to the return flow hole at the suction gallery.

Set the suction gallery pressure to 1.5 bar.

Drive the fuel-injection pump at the speed given in the box in Section "A" in the test-specification sheet. Adjust the control-rod travel to the specified value using the control-rod travel measuring device, and fix it in this position. Check the amount of fuel injected.

The basic fuel-delivery setting applies as a pre-setting (100-stroke measurement) and is adjusted by turning the barrel-and-valve assembly.

For this purpose release the fuel-injection tubing (apply counterpressure to the delivery-valve holder when doing this) and the hexagon nuts at the barrel-and-valve assembly.

Retighten the hexagon nuts at the barrel-and-valve assembly as well as the union nut at the fuel-injection tubing.

**Tightening torques:**

	Nm	kg/m
Hexagon nuts	20-25	2-2.5

The permissible difference in fuel delivery given in column 4 of the test-specification sheet applies for the plunger-and-barrel assemblies of **one** fuel-injection pump.

The fuel delivery given in column 3 is the average value for **all** plunger-and-barrel assemblies of one pump.

The governor, full-load delivery, and the final value of the fuel delivery difference are adjusted according to the corresponding test instructions [RQ (V), EP/RS (V)] as well as Sections "B" and "C" of the test-specification sheet.

**4. Auxiliary Tools**

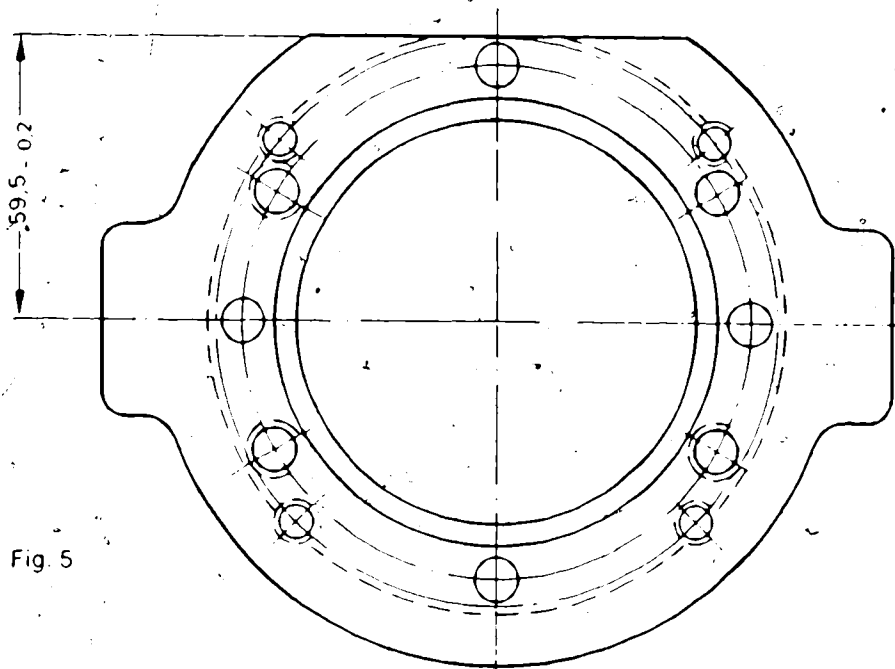


Fig. 5

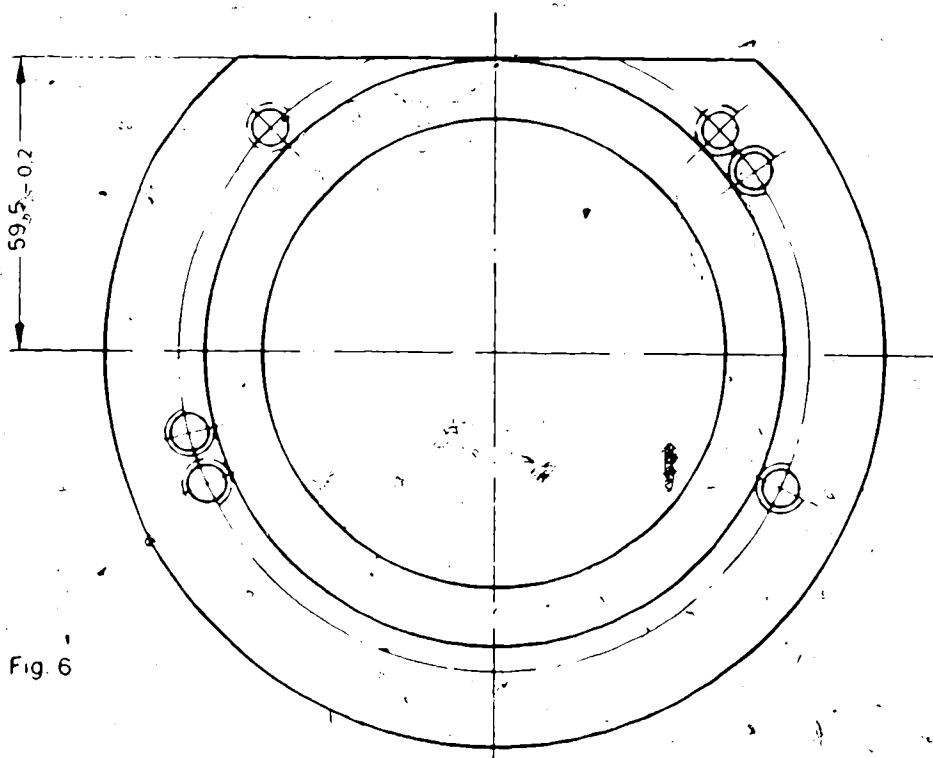


Fig. 6

# After-sales Service Instructions

## Testing

41

VDT-W-413/301 En  
Suppl. 2  
Ed. 1

## Fuel-injection pumps

PE (S) - MW  
and RW governors  
with port-closing sensor system (FBG)

This publication has been redesigned with the forthcoming change-over to microfilm in mind. When a publication has been transferred to microfilm, the screen will be filled completely by a quarter of a printed-publication page. For this reason, it is unavoidable that illustrations are repeated in the case of longer texts in which reference is constantly being made to a particular illustration.

Until the change-over to microfilm, we have slightly reduced the size of the print and of the illustrations.

Contents

Coordinates

1. Introduction.....	A 2
2. <del>Testing part</del> Closing and setting prestroke.....	A 3

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Published by: After-Sales Service Department for Training and Technology (KH/VSK). Press date: 6.83.

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Printed in the Federal Republic of Germany.

Imprimé en République Fédérale d'Allemagne par Robert Bosch GmbH.

**A1**

Table of contents/impressum

PE(S) .. MW ..



## 1. Introduction

This supplement to Testing Instructions VDT-W-413/301 refers to the testing and adjusting of fuel-injection pumps PE(S) .. MW .. with port-closing sensor system.

The construction and operation of these fuel-injection pumps is described in Motor Vehicle Service Information VDT-I-413/1 (4.83).

**A2**

Introduction

PE(S) .. MW ..

## 2. Testing port-closing and setting prestroke

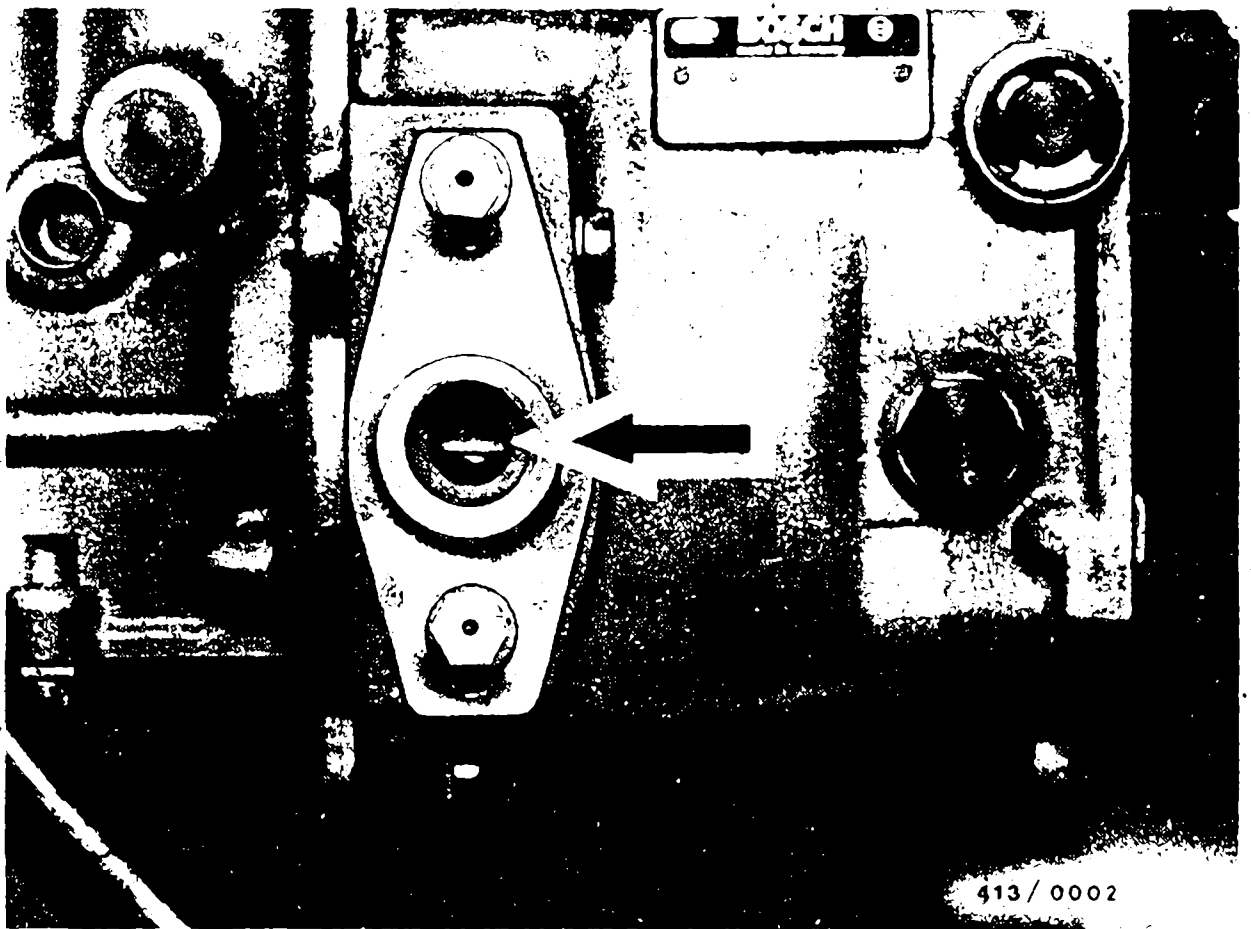
Test fuel-injection pump PE(S) .. MW .. in accordance with Testing Instructions VDT-W-413/301 - Ed. 1 - up to and including page 5, Section 3 ("... close bleeder screw of nozzle-holder assembly").

**A3**

Testing

PE(S) ... MW ..

C4



## 2.1 Different operations for governors with FBG system

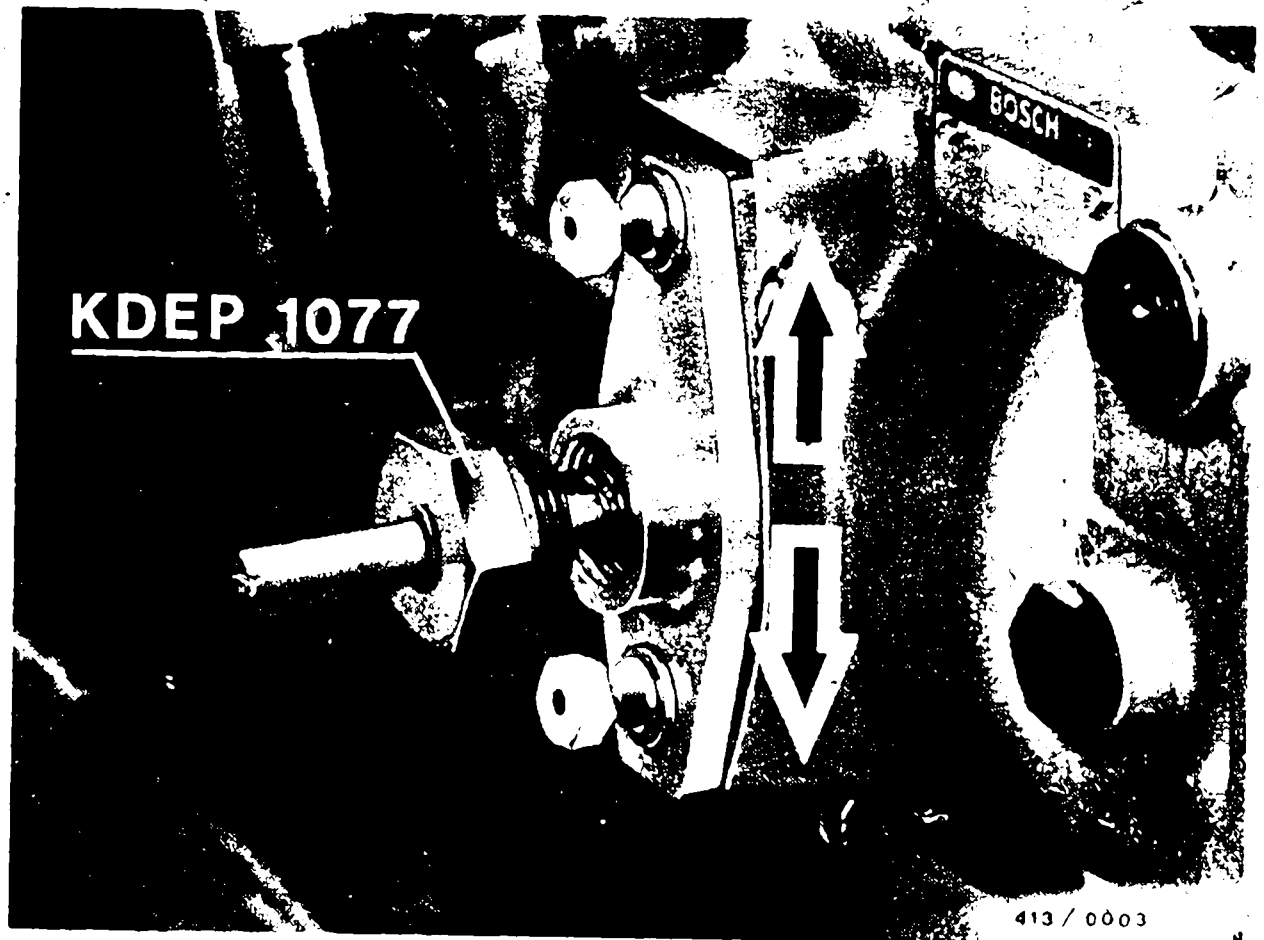
Turn the camshaft a further  $19.5^\circ$  in its direction of rotation.

In this position the lug on the flyweight must be visible in the tapped hole (arrow) of the sliding flange.

**A4**

Testing

PE(S) .. MW ..



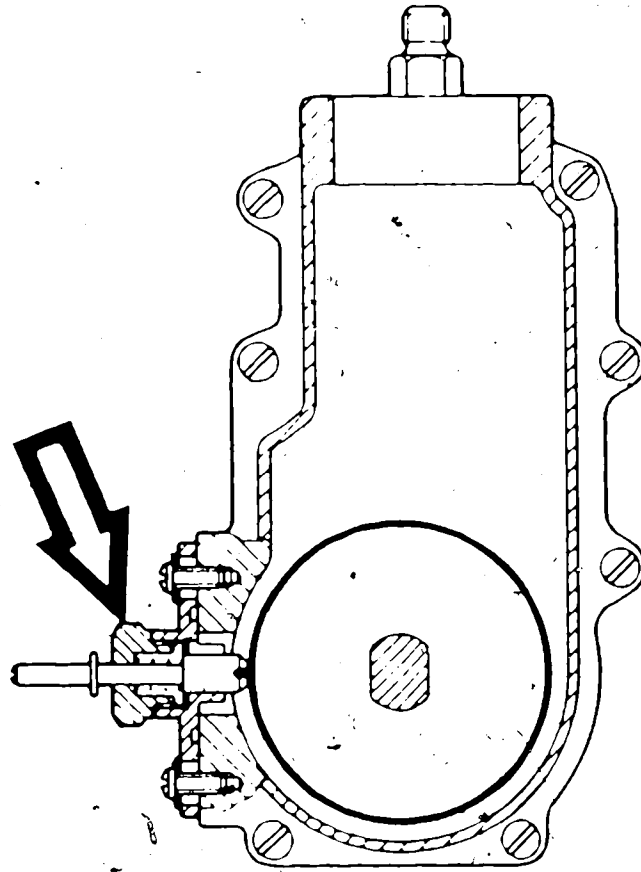
Insert the blocking device KDEP 1077 into the sliding flange.

Move the sliding flange in the region of the slots until the slit of the blocking device engages the lug of the flyweight part and blocks it.

**A5**

Testing

PE(S) .. MW ..



413/0004

Screw the union nut of the blocking device (arrow) into the port-closing sensor bore and tighten the sliding flange. Use new break-off screws and twist off the head of the screw when tightening.

Remove blocking device KDEP 1077.

Remove prestroke measuring device and seal tapped hole with screw plug and new seal ring.

For the further working steps, proceed in accordance with Testing Instructions VDT-W-413/301 - Ed. 1 - starting on page 5 "The port closing of the other elements ...".

**A6**

Testing

PE(S) .. MW ..